

Sub 1  
cleaning liquid is heated to a high temperature and forced into the enclosure under high pressure as finely dispersed or diffused droplets forming a mist or vapour so that a pressure greater than atmospheric is maintained in the enclosure to force the cleaning liquid into at least the surface if not through and into the very structure of the material from which the articles are formed, so as to assist the cleaning process, and wherein the enclosure is in the form of an elliptical capsule mounted for rotation about an axis through the mid-point of its longer axis, so that articles located therein will tend to fall from one end to the other as the capsule is rotated thereby to assist in the mixing of the liquids introduced into the capsule.

42  
52. A machine as claimed in claim 51, wherein the cleaning liquid is removed from the articles and the interior of the enclosure by means of a suction pump and replaced by clean liquid for rinsing.

53. A machine as claimed in claim 52, wherein the liquid supplied for rinsing is also at higher than atmospheric pressure.

54. A machine as claimed in claim 52, wherein the rinsing liquid is also heated above ambient temperature.

55. A machine as claimed in claim 52, wherein during a drying cycle following washing and/or a rinsing cycle the suction pump is employed to reduce the pressure on the downstream side of the enclosure substantially below atmospheric, so that evaporative drying of moisture remaining on or in the material from which the articles are formed, occurs:

Sub B1

✓

# THE UNIVERSITY OF CHICAGO

59. A machine as claimed in claim 51, wherein a filter is provided at the inlet to the enclosure and liquid is finely dispersed and/or diffused on entry into the enclosure by forcing it therethrough.

60. A machine as claimed in claim 51, in which the capsule is to be loaded and unloaded through a circular opening in the front wall of a rectangular housing within which the capsule is located for rotation, and wherein the opening in the front housing wall is normally closed by a hinged circular door, the front opening (and in consequence the door also), is arranged coaxially relative to the axis of rotation of the capsule, and the capsule includes a circular opening which aligns with the

Sub B1  
circular front housing opening, and an annular seal is provided between the two openings to enable a positive pressure to be maintained in the capsule after the door has been closed.

61. A machine as claimed in claim 60, wherein the capsule is mounted for rotation by two rotary support bearing assemblies, one surrounding the loading and unloading opening and the other attached to a diametrically opposite region of the cylindrical wall of the mid-region of the capsule coaxial with the first bearing assembly.

A~  
62. A machine as claimed in claim 61, wherein the second bearing assembly surrounds a circular region in the capsule wall opposite to the loading and unloading opening, and concentric pipe means having a rotary seal with the wall of the capsule, enables the capsule to rotate whilst still being connected to the liquid and air supplies and also allows liquid and air to enter the capsule whilst the latter rotates.

63. A machine as claimed in claim 60, wherein the opposite ends of the capsule include sieve-type filters and the pipe means delivers liquid and air to the two filters to enter the interior of the capsule from opposite ends thereof.

64. A machine as claimed in claim 60, wherein a hollow cylindrical sleeve extends across the interior of the capsule coaxial with the aligned support bearing axes which define the axis of rotation of the capsule, and the sleeve wall is perforated with tiny apertures through which the liquid and air exit into the interior of the capsule as a fine mist diffused by the tiny perforations, which form a cylindrical fine mesh sieve type filter.

65. A machine for washing as claimed in claims 60, wherein a heater is provided to heat the water to boiling point so that at least part of the liquid entering the capsule is in the form of steam vapour.

66. A machine as claimed in claim 65, wherein the air expands due to its being heated after coming into contact with the steam so that a further increase in pressure within the capsule results causing the detergent suds to more thoroughly permeate the articles particularly where the latter are formed from woven fabric, so further assisting the release of dirt and particles causing stains and marks in the fabric.

67. A machine as claimed in claim 60, wherein the vacuum, the temperature, and the pressure are displayed in an analogue or digital display (preferably an analogue LCD bar display) on the front of the machine housing.

68. A method of washing articles using a machine as claimed in claim 52, comprising the steps of:

- inserting an article or articles to be washed, into a sealable capsule,
- sealing the capsule
- introducing a detergent solution at or around boiling point together with steam into the sealed capsule, under a pressure greater than ambient
- rotating the capsule to agitate the article(s) and effect a mixing of the liquid and steam therewith
- pumping the liquid from the capsule after a predetermined time
- introducing clean water into the capsule and further rotating same to rinse the articles

- Sub B1
- pumping the rinsing water from the capsule after a predetermined time
  - continuing to pump the capsule so as to lower the pressure therein to below atmospheric for a further predetermined period of time to assist in evaporative drying of the article(s) therein
  - removing the article(s) after establishing ambient pressure in the capsule.

69. A machine as claimed in claim 51, which includes a reservoir of a volatile cleaning fluid such as isopropyl alcohol, means for introducing the fluid into the capsule with one or more items of clothing or the like which are to be dry cleaned, means for sealing the capsule so as to provide a gas-tight compartment, means for rotating the capsule in the range 80-100rpm, prior to unsealing the capsule to remove the clothing or like articles, and suction pump means, particularly a venturi vacuum pump, for extracting vapours and gases left over from the cleaning process.

70. A machine for washing articles which comprises a sealable enclosure for containing the articles to which a mixture of detergent and water (washing liquid) is to be supplied, characterised in that the liquid is heated to a high temperature and forced into the enclosure under high pressure so as to form a two phase vapour or mist of finely dispersed or diffused droplets of liquid and steam, and a pressure greater than atmospheric is maintained in the enclosure to force the liquid into at least the surface if not through and into the very structure of the material from which the articles are formed, so as to assist the washing process.

71. A machine for washing articles which comprises a sealable enclosure for containing the articles to which a mixture of detergent and water (washing liquid) is to be supplied, characterised in that the washing liquid is heated to a high temperature and forced into the enclosure under high

Sub B  
pressure as finely dispersed or diffused droplets forming a mist or vapour so that a pressure greater than atmospheric is maintained in the enclosure to force the washing liquid into at least the surface if not through and into the very structure of the material from which the articles are formed, so as to assist the cleaning process, wherein the washing liquid is removed from the articles and from the interior of the enclosure by means of a suction pump.

pc  
72. A machine as claimed in claim 71 wherein the suction pump is a venturi pump and water is supplied thereto under pressure by a pump (16), and after leaving the venturi pump, the water is conveyed to a sump (150) which includes a return pipe (154) for returning the water to the pump (116).

73. A method of washing articles comprising the steps of:

- inserting an article or articles to be washed into a sealable capsule,
- sealing the capsule, and further characterised by the steps of:-
- introducing a detergent solution at or around boiling point together with steam into the sealed capsule, under a pressure greater than ambient
- rotating the capsule to agitate the article(s) and effect a mixing of the liquid and steam therewith
- pumping the liquid from the capsule after a predetermined time
- introducing clean water into the capsule and further rotating same to rinse the articles
- pumping the rinsing water from the capsule after a predetermined time
- continuing to pump the capsule so as to lower the pressure therein to below atmospheric for a further predetermined period of time to assist in evaporative drying of the article(s) therein, and
- removing the article(s) after establishing ambient pressure in the capsule.